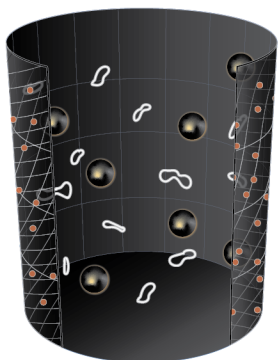


# Spacetime Holography

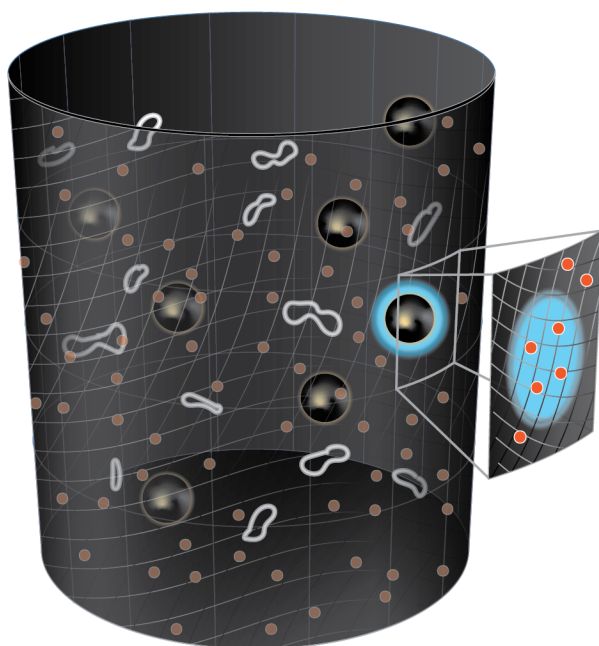
Equations controlling the behaviour of black holes and strings under gravity, in a specific kind of space, are mathematically equivalent to the equations governing the interactions of quantum systems. This relationship suggests that space is in some sense emergent from quantum interactions. This concept is called holography.



**a)** The black holes and strings live within a hypothetical 3-D anti-de Sitter (AdS) space, governed by gravity.

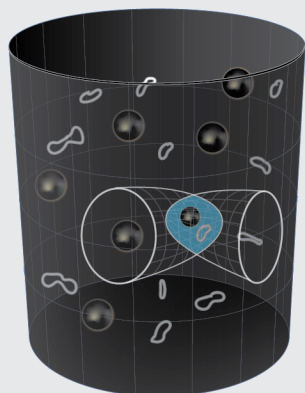


**b)** Meanwhile, more familiar particles live on the 2-D boundary of this space, which is threaded by quantum fields (obeying a so-called conformal field theory (CFT)).



**c)** The behaviour of specific objects in the 3-D bulk can be calculated by analysing the behaviour of related quantum systems on the boundary, and vice-versa. This is the AdS/CFT duality.

- Particle
- Quantum field
- String
- Black hole



## Causal Wedge Paradox

**d)** Any section on the boundary defines a wedge in the bulk. The behaviour of all objects in the bulk can be said to be controlled by the quantum interactions in the dual section on the boundary.

But some objects in the bulk lie in multiple wedges. This appeared to create a paradox, until it was understood that different sections of the boundary provide complementary and consistent instructions to objects that lie in the overlap region.